

## Complete Summary

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### GUIDELINE TITLE

Surgical management of acute epidural hematomas.

### BIBLIOGRAPHIC SOURCE(S)

Bullock MR, Chesnut R, Ghajar J, Gordon D, Hartl R, Newell DW, Servadei F, Walters BC, Wilberger JE, Surgical Management of Traumatic Brain Injury Author Group. Surgical management of acute epidural hematomas. Neurosurgery 2006 Mar; 58(3 Suppl):S2-7-S2-15. [41 references] [PubMed](#)

### GUIDELINE STATUS

This is the current release of the guideline.

## COMPLETE SUMMARY CONTENT

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## SCOPE

### DISEASE/CONDITION(S)

Acute epidural hematoma

### GUIDELINE CATEGORY

Management  
 Treatment

### CLINICAL SPECIALTY

Emergency Medicine  
 Neurological Surgery  
 Neurology

## INTENDED USERS

Physicians

## GUIDELINE OBJECTIVE(S)

To present rigorous literature-based recommendations for the surgical management of patients with epidural hematomas

## TARGET POPULATION

Patients with acute epidural hematomas

## INTERVENTIONS AND PRACTICES CONSIDERED

1. Surgical evacuation
2. Neurological observation
3. Computed tomography (CT) scan
4. Glasgow Coma Scale (GCS) score
5. Assessment of comorbidities
6. Pupillary exam
7. Intracranial pressure monitoring
8. Timing of surgery

## MAJOR OUTCOMES CONSIDERED

- Mortality rate
- Functional outcome

## METHODOLOGY

### METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)  
Hand-searches of Published Literature (Secondary Sources)  
Searches of Electronic Databases

### DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

A MEDLINE computer search using the following keywords for the years 1975 to 2001 was performed: "traumatic brain injury" or "head injury" and "epidural" or "extradural" and "hematoma" or "hematoma" or "hemorrhage." The search was narrowed by including the keywords "surgical treatment" or "surgery" or "operation" or "craniotomy" or "craniectomy" or "craniostomy" or "burr holes" and excluding "spinal." These searches combined yielded 168 articles. The reference lists of these publications were reviewed and an additional 22 articles were selected for analysis. Case reports, publications in books, and publications regarding penetrating brain injuries on spinal epidural hematoma (EDH) and on exploratory burr holes without a preoperative computed tomographic (CT) scan were not included. Articles were excluded if the diagnosis of EDH was not based

on CT scanning, or if subgroups of patients who did not undergo CT scanning were not clearly identified. Publications with fewer than 10 patients or publications that did not include information on outcome were excluded.

## NUMBER OF SOURCE DOCUMENTS

Of the 190 articles, 18 were selected for analysis

## METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

## RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

### Classification of Evidence

When assessing the value of therapies or interventions, the available data was classified into one of the following three categories according to the following criteria:

Class I: Evidence from one or more well-designed, randomized, controlled clinical trials, including overviews of such trials

Class II: Evidence from one or more well-designed comparative clinical studies, such as nonrandomized cohort studies, case-control studies, and other comparable studies

Class III: Evidence from case series, comparative studies with historical controls, case reports, and expert opinion

## METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

## DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

### Evaluation and Weighting of the Evidence

The journal articles found have been carefully read and evaluated, including an assessment of the methodology used in the studies. This not only includes the establishment of the clinical question addressed (e.g., therapeutic effectiveness, diagnostic tests, prognostic studies, etc.) and type of study (randomized controlled trial, case-control study, case series, etc.), but also the quality of the study with respect to potential errors in design, execution, or conclusions reached. Therefore, studies that might, on the surface, represent evidence supporting one level of recommendation, may instead be flawed enough to be devalued to support a recommendation of lesser strength. The quality of the literature was evaluated in this way according to well-established criteria. All articles were cross-reviewed and disagreements were resolved by consensus.

## METHODS USED TO FORMULATE THE RECOMMENDATIONS

### Expert Consensus

## DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

### Link Between Evidence and Guidelines

The general concept of relating strength of recommendations to strength of evidence reflecting varying degrees of clinical certainty was formalized into a scheme that has been followed by medical societies, including organized neurosurgery, from the inception of the Guideline development process. Despite problems with the strict application of this paradigm (some of which are displayed and discussed in this supplement), the scheme has the benefit of using scientific evidence rather than expert opinion for the substrate of the recommendations, although expert opinion is used to formulate the recommendations themselves, as well as to make judgments regarding the quality of the evidence. The evidence-based scheme used in these and all Guidelines regarding therapeutic effectiveness endorsed by the American Association of Neurological Surgeons and the Congress of Neurological Surgeons begins with classification of the literature into three categories of evidence (see "Rating Scheme for the Strength of the Evidence" above).

The classification of evidence into these three categories leads to the formulation of recommendations called Standards, Guidelines, and Options. Class I evidence is used to support treatment recommendations of the strongest type, practice Standards, reflecting a high degree of clinical certainty. Class II evidence is used to support Guidelines, reflecting a moderate degree of clinical certainty. Class III evidence supports practice Options reflecting unclear clinical certainty. This terminology was developed to indicate, in normal vocabulary, the strength of the recommendations on the basis of strong to weak medical evidence. In neurosurgery, this scheme has been used to formulate Guidelines, rather than a scheme that uses letters or numbers that have no grounding in language and are, therefore, more easily misinterpreted. The link between scientific evidence and recommendations has been highlighted in these Guidelines by presenting those studies in the scientific foundation that support the stated recommendation in boldface type.

### Expert Judgment and Empirical Evidence

There are two ways in which expert judgment comes into Guideline development. The most common use of expert opinion is in developing recommendations for practice. This has been a usual method in the past (as well as the present, in the form of textbook chapters), but has more recently given way to more formalized approaches embraced by evidence-based medicine methodology, such as that used in this supplement. However, even in evidence-based methodology, expert opinion is used to evaluate the literature as well as to frame the concepts and wording of the recommendations. In addition, if the evidence is weak and conflicting, expert opinion is used to derive recommendations. This use is unavoidable, but the expert opinion is guided by the evidence published in the literature, rather than from personal experience alone.

## RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

### Levels of Recommendations

Standards: Represent accepted principles of patient management that reflect a high degree of clinical certainty.

Guidelines: Represent a particular strategy or range of management strategies that reflect a moderate degree of clinical certainty.

Options: Are the remaining strategies for patient management for which there is unclear clinical certainty.

## COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

## METHOD OF GUIDELINE VALIDATION

Peer Review

## DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

In all Guidelines published under the auspices of the Brain Trauma Foundation and the American Association of Neurological Surgeons, other professional organizations were involved in either developing the Guidelines or reviewed and approved them. In these Surgical Management of Traumatic Brain Injury Guidelines, however, only neurosurgeons were involved. These neurosurgeons represent a wide range of organizations. There were representatives from the American Association of Neurological Surgeons, the Congress of Neurological Surgeons, the European Brain Injury Consortium, the American College of Surgeons (Committee of Trauma) and the World Federation of Neurological Surgeons (Neurotrauma section) involved in the development of these Surgical Management of Traumatic Brain Injury Guidelines.

## RECOMMENDATIONS

### MAJOR RECOMMENDATIONS

"Degrees of Certainty" [Standards, Guidelines, Options] and "Classification of Evidence" [Class I to III] are defined at the end of the "Major Recommendations" field.

Note: All of the following recommendations are at the Option level supported only by Class III scientific evidence.

#### Recommendations

Indications for Surgery

- An epidural hematoma (EDH) greater than 30 cm<sup>3</sup> should be surgically evacuated regardless of the patient's Glasgow Coma Scale (GCS) score.
- An EDH less than 30 cm<sup>3</sup> and with less than a 15-mm thickness and with less than a 5-mm midline shift (MLS) in patients with a GCS score greater than 8 without focal deficit can be managed nonoperatively with serial computed tomographic (CT) scanning and close neurological observation in a neurosurgical center.

### Timing

- It is strongly recommended that patients with an acute EDH in coma (GCS score <9) with anisocoria undergo surgical evacuation as soon as possible

### Methods

- There are insufficient data to support one surgical treatment method. However, craniotomy provides a more complete evacuation of the hematoma.

### Summary

In patients with an acute EDH, clot thickness, hematoma volume, and MLS on the preoperative CT scan are related to outcome. In studies analyzing CT parameters that may be predictive for delayed surgery in patients undergoing initial nonoperative management, a hematoma volume greater than 30 cm<sup>3</sup>, an MLS greater than 5 mm, and a clot thickness greater than 15 mm on the initial CT scan emerged as significant. Therefore, patients who were not comatose, without focal neurological deficits, and with an acute EDH with a thickness of less than 15 mm, an MLS less than 5 mm, and a hematoma volume less than 30 cm<sup>3</sup> may be managed nonoperatively with serial CT scanning and close neurological evaluation in a neurosurgical center (see Appendix II of the original guideline document for measurement techniques). The first follow-up CT scan in nonoperative patients should be obtained within 6 to 8 hours after traumatic brain injury (TBI). Temporal location of an EDH is associated with failure of nonoperative management and should lower the threshold for surgery. No studies are available comparing operative and nonoperative management in comatose patients. The literature supports the theory that patients with a GCS less than 9 and an EDH greater than 30 cm<sup>3</sup> should undergo surgical evacuation of the lesion. Combined with the above recommendation, it follows that all patients, regardless of GCS, should undergo surgery if the volume of their EDH exceeds 30 cm<sup>3</sup>. Patients with an EDH less than 30 should be considered for surgery but may be managed successfully without surgery in selected cases.

Time from neurological deterioration, as defined by onset of coma, pupillary abnormalities, or neurological deterioration to surgery, is more important than time between trauma and surgery. In these patients, surgical evacuation should be performed as soon as possible because every hour delay in surgery is associated with progressively worse outcome.

### Definitions:

### Degrees of Certainty

Standards: Represent accepted principles of patient management that reflect a high degree of clinical certainty.

Guidelines: Represent a particular strategy or range of management strategies that reflect a moderate degree of clinical certainty.

Options: Are the remaining strategies for patient management for which there is unclear clinical certainty.

#### Classification of Evidence on Therapeutic Effectiveness

Class I: Evidence from one or more well-designed, randomized, controlled clinical trials, including overviews of such trials

Class II: Evidence from one or more well-designed comparative clinical studies, such as nonrandomized cohort studies, case-control studies, and other comparable studies

Class III: Evidence from case series, comparative studies with historical controls, case reports, and expert opinion

#### CLINICAL ALGORITHM(S)

None provided

### EVIDENCE SUPPORTING THE RECOMMENDATIONS

#### TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are all at the Option level, supported only by Class III scientific evidence (e.g., evidence from case series, comparative studies with historical controls, case reports, and expert opinion)

### BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

#### POTENTIAL BENEFITS

Appropriate surgical management of epidural hematoma (EDH) to improve clinical outcomes and reduce morbidity and mortality

#### POTENTIAL HARMS

Not stated

### QUALIFYING STATEMENTS

#### QUALIFYING STATEMENTS

As in all other areas of evidence-based medicine, these Guidelines have been formulated strictly in accordance with externally imposed constraints. Only clinical human-based literature has been reviewed. Only literature from 1975 through 2001 has been reviewed. Mainly literature in English, with far fewer articles in other languages, was reviewed. For these reasons, the reader must clearly understand that the scope and level of magnitude of the recommendations made here are distilled from the available literature and interpreted according to the rules of evidence-based medicine.

## IMPLEMENTATION OF THE GUIDELINE

### DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

## INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

### IOM CARE NEED

Getting Better

### IOM DOMAIN

Effectiveness  
Timeliness

## IDENTIFYING INFORMATION AND AVAILABILITY

### BIBLIOGRAPHIC SOURCE(S)

Bullock MR, Chesnut R, Ghajar J, Gordon D, Hartl R, Newell DW, Servadei F, Walters BC, Wilberger JE, Surgical Management of Traumatic Brain Injury Author Group. Surgical management of acute epidural hematomas. Neurosurgery 2006 Mar;58(3 Suppl):S2-7-S2-15. [41 references] [PubMed](#)

### ADAPTATION

Not applicable: The guideline was not adapted from another source.

### DATE RELEASED

2006 Mar

### GUIDELINE DEVELOPER(S)

Brain Trauma Foundation - Disease Specific Society

### SOURCE(S) OF FUNDING



Brain Trauma Foundation  
Integra NeuroSciences

#### GUIDELINE COMMITTEE

Not stated

#### COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

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#### FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

#### ENDORSER(S)

Congress of Neurological Surgeons - Professional Association

#### GUIDELINE STATUS

This is the current release of the guideline.

#### GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the [Brain Trauma Foundation Web site](#).

Print copies: Available from Jamshid Ghajar, MD, PhD, Brain Trauma Foundation, 708 Third Avenue, Suite 1810, New York, NY 10017, Email: [ghajar@braintrauma.org](mailto:ghajar@braintrauma.org)

#### AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Introduction. Neurosurgery 2006 Mar; 58(3 Suppl): S2-1-S2-3.
- Methodology. Neurosurgery 2006 Mar; 58(3 Suppl): S2-4-S2-6.

Electronic copies: Available in Portable Document Format (PDF) from the [Brain Trauma Foundation Web site](#).

Print copies: Available from Jamshid Ghajar, MD, PhD, Brain Trauma Foundation, 708 Third Avenue, Suite 1810, New York, NY 10017, Email: [ghajar@braintrauma.org](mailto:ghajar@braintrauma.org)

## PATIENT RESOURCES

None available

## NGC STATUS

This NGC summary was completed by ECRI on August 14, 2006. The information was verified by the guideline developer on August 18, 2006.

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Date Modified: 9/25/2006